"Evaluating the incorporation of Constructivism in NCERT Science textbook of Secondary Education"

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1. INTRODUCTION

Education is a multifaceted and complex process that involves the acquisition of knowledge, skills, values, and attitudes. It is a fundamental aspect of human development and plays a crucial role in shaping individuals and societies. While education can take various forms and occur in a wide range of settings, its primary purpose is to facilitate learning and personal growth.

Different Indian philosophers have provided diverse insights into the nature and purpose of education.

Swami Vivekananda, a key figure in the introduction of Indian philosophies of Vedanta and Yoga to the Western world, emphasized the holistic development of an individual. **Education is the manifestation of perfection already in man."- Swami Vivekananda**. He believed that education should not be seen as the process of filling an empty vessel but as the realization and manifestation of the innate potential and perfection that already exists within each individual. Education should bring out the best in a person.

Rabindranath Tagore, a Nobel laureate poet and philosopher, founded **Shantiniketan**, a unique educational institution. He advocated for a more liberal and artistic approach to education. Tagore believed that education should be a harmonious blend of nature, culture, and creativity. He emphasized the importance of a close relationship between the teacher and the student, where learning is a joyful and interactive process.

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Constructivism is a learning theory that posits that learners actively construct knowledge by assimilating new information into their existing mental frameworks, or schemas. Rooted in the work of educational philosophers such as **Jean Piaget**, **Lev Vygotsky**, and **Jerome Bruner**, constructivism emphasizes on some key principles such as Active Engagement, Prior Knowledge, Social Interaction, Zone of Proximal Development (ZPD), Meaningful Context, Reflection and Metacognition

The integration of constructivist principles in curriculum design has gained increasing attention in recent years. Constructivism posits that knowledge is actively constructed by the learner through meaningful interactions with the environment, experiences, and social interactions. In the context of science education, this implies a shift from traditional, teacher-centered approaches to student-centered methodologies that emphasize exploration, inquiry, and the application of knowledge. However, the extent to which these constructivist ideas are embraced and implemented in the development of science curricula remains a subject of inquiry and debate. Constructivist concepts in the development of science curriculum influence in many different ways such as: Active Learning Strategies, Building on Prior Knowledge, Collaborative Learning, Scaffolding and Differentiation.

In the context of the **National Curriculum Framework (NCF) 2005**, science curriculum and constructivism are closely intertwined. NCF 2005 provides the overarching educational framework, while science curriculum development and the incorporation of constructivist principles align with the goals and philosophy outlined in NCF 2005.

2. SIGNIFICANCE OF THE PROBLEM

In a constructivist approach to science education, the focus should be on nurturing science process skills and enabling them to actively observe, measure, classify, process

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information, think critically to solve problems, analyze data, synthesize findings, formulate conclusions, and, crucially, nurture their creativity within the scientific context.

To achieve the goals of science education, well-crafted textbooks play a pivotal role. A quality textbook aligns with the objectives of science instruction and can offer invaluable support to both teachers and students. When educators utilize such textbooks, they unlock a multitude of benefits for both those imparting knowledge and those acquiring it.

In the course of this research, the researcher will undertake an examination of the secondary school NCERT science textbook, focusing on the assessment of its integration of constructivist principles within the context of Class 10th secondary education.

3. STATEMENT OF THE PROBLEM

"Evaluating the incorporation of Constructivism in NCERT Science textbook of Secondary Education"

4. OPERATIONAL DEFINITIONS OF THE TERMS

- Constructivism - Constructivism refers to a pedagogical philosophy and instructional approach that emphasizes active learning, where students construct knowledge and understanding through hands-on experiences, problem-solving, critical thinking, and collaborative activities. In the research, it involves assessing how well the science textbook aligns with and facilitates this constructivist approach in the context of secondary education as provided by NCERT (National Council of Educational Research and Training).
- Secondary Education – Secondary Education refers to the educational level typically encompassing students in grades 9 and 10, as per the education system in India. It represents a crucial stage in a student's academic journey, where they build upon foundational knowledge acquired in earlier years and prepare for higher education or vocational training. In the specific context of this research, secondary education refers to

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the academic stage covered by the NCERT's curriculum for Class 10th students, focusing on the science textbook used in this grade.

- Textbook- A textbook refers to a written and structured educational resource officially approved by the NCERT for use in secondary education. These textbooks serve as the primary instructional materials for teachers and students, containing organized content, explanations, examples, exercises, and activities related to the subject of science. For this research, "textbook" specifically denotes the official science learning material designated for use by students and educators in the secondary education system for class 10th students under the purview of NCERT.

5. OBJECTIVES OF THE STUDY

The researcher will take following objectives of the research:

Major Objectives :

"Evaluating the incorporation of Constructivism in NCERT Science textbook of Secondary Education"

Minor Objectives :

- To assess the extent to which the NCERT's secondary education science textbook aligns with the principles of constructivist pedagogy.
- To evaluate the clarity and effectiveness of the textbook's content presentation in facilitating student engagement and active learning in a constructivist manner.
- To analyze the inclusion of real-world examples, case studies, and practical applications in the textbook that promotes the construction of knowledge and problem-solving skills.
- To provide suggestion for potential improvements or modifications to the textbook's content and design to enhance its alignment with constructivist principles in secondary education.

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6. RESEARCH QUESTIONS

- Does the NCERT's secondary education science textbook align with the principles of constructivist pedagogy and to what extent?
- Is the clarity and effectiveness of the textbook's content presentation evaluated for its role in facilitating student engagement and active learning in a constructivist manner?
- Is the inclusion of real-world examples, case studies, and practical applications in the textbook analyzed for its role in promoting the construction of knowledge and problem-solving skills?

7. DELIMITATION OF THE STUDY

- **Textbook:**

The focus will center the research on analyzing the science textbook itself. Secondary Education:

- **Secondary Education:**

This topic narrows the scope to class 10th only.

8. REVIEW OF THE RELATED LITERATURE

Umashree (1999) conducted a study entitled "Science Curriculum and its Transaction: An Exploratory Study in Secondary School of Vadodara. The data analysis was done through content analysis. The findings of study were majority of teachers (eighty-three) indicated that the *objectives of teaching science were precise. Teachers created space for student's participation.* Lecture method was the most convenient to use as large chunks of information could be conveyed in less amount of time.

Gupta (2000) suggested a constructivist learning model especially for science education in school setting based on recent advances made in psychological, social and neuro-cognitive

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research by considering active, interactive, real and creative environment supported by technology for the active system.

Duffy and Kirkley (2004) reported in constructivist view, learner is not a passive recipient of information rather she/he can manipulate, interpret and make sense of her/his environment using experiences. High order thinking skills can help in making senses from the environment.

According to **Pandey, Saroj (2004)** the constructivist based pedagogical models include collaborative learning techniques, discussion forums and jurisprudential models to clarify concept and facilitate learning. She further states that meaningful understanding occurs when students develop effective ways to resolve problems and think critically.

According to **Sharma, S (2006)** a constructivist teacher is leader of democratic learning group, he accepts student's autonomy and initiative, encourages student to analyze, interpret and predict, ask open ended questions and use raw data as primary sources and interactive material. All such activities promotes critical and creative thinking among the learners.

Phillips D.C. (2007) applied constructivist approach in science and he found that the qualitative terms of learning are in-depth rather than through traditional approach.

Roth, W.M., & Lee, S. (2007). Conducted their studies on "Science Education as/for Participation in the Community." This source discusses science education in the context of community participation, which can relate to how textbooks prepare students for real-world engagement but it may not directly address textbook evaluation but offers a broader perspective on science education.

Chin, C., & Osborne, J. (2008). *Conducted their studies on "Students' questions: a* potential resource for teaching and learning science." This study explores the role of student-generated questions in science education, which aligns with constructivist principles of active inquiry.

Minner, D.D., Levy, A.J., & Century, J. (2010). Conducted their studies on "Inquiry-Based Science Instruction—What Is It and Does It Matter? Results from a Research Synthesis

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Years 1984 to 2002." This meta-analysis examines the effectiveness of inquiry-based learning, a constructivist approach, in science education.

Nilgun Secken and Eviram Ural Alsan(2011) did a research on the "effect of constructivist approach on student's understanding of the concepts related hydrolysis". The *Objective Of This Research was to find the effect of constructivist approach on student's* understanding of the concepts related to hydrolysis subject, comparing constructivist approach with traditional teaching method and determined the difference between student's success in constructivist approach and traditional teaching method. The Finding of the Research was that the Constructivist approach is more effective than the traditional approach because it enhanced the critical thinking.

Tyagi, Ketika (2012) conducted a research on "A study of influence of constructivism in teaching on academic achievement, creative thinking and academic motivation of primary class students." She found that constructivist based teaching significantly improve academic *achievement in comparison to traditional method of teaching of class IV students.*

Jain and Bharadwaj (2012) conducted a study entitled "5E Model in Science Classroom, A shift towards constructivism." They enlightened the fact that learning by doing is the essence of science and for science classroom, constructivism seems promising learning philosophy. In the light of this, the authors have attempted to enlightened the 5E model based on constructivism and tried to comprehend its usage in our science classrooms for better understanding of scientific concepts. The use of this model brought coherence to different teaching strategies, provided connections among educational activities, and helped science teachers make decisions about interactions with students.

9. RESEARCH METHODOLOGY

This chapter presents an overview of the Research design of the proposed study.

RESEARCH DESIGN:

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This study will employ a descriptive and qualitative research design to evaluate the incorporation of constructivism in science textbooks for secondary education in NCERT. The selected textbooks will be subjected to content analysis as a method of study.

In this research, the researcher will examine each and every chapter of class X NCERT textbook.

Analysis will be made with respect to Constructivism with the outline by the researcher.

The frequency of depiction of Constructivism in the chapters of science textbooks will be tabulated and calculated thereafter.

SOURCES OF STUDY

(a) **Primary Source:**

With an intention to analyze the curricular objectives of the secondary school for Constructivism, X standard NCERT science textbooks will be taken as the primary source of the study.

(b) **Secondary Source:**

To analyze the incorporation of Constructivism, magazines, articles, abstracts, newspaper, etc. can also be used as the secondary source.

SAMPLE SELECTION

A purposive sampling approach will be used to select a sample of science textbooks currently prescribed for secondary education by NCERT.

10. DATA ANALYSIS AND INTERPRETATION

Qualitative data from the content analysis will be coded and categorized based on identified themes related to the presence or absence of constructivist elements in the textbooks.

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11. CHAPTERISATION:

The research report will consist of following chapters:-

1. Introduction.
2. Review of related literature.
3. Research Methodology.
4. Analysis of NCERT science textbook of Class 10^{th}.
5. Interpretation of data.
6. Conclusion and Suggestion.

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Appendix

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